REMARKS

Applicants and their undersigned attorney have carefully reviewed the first Office Action of March 2, 2006 in the above-identified patent application, together with the prior art references cited and relied on by the Examiner in the rejections of the claims. Applicants believe that the present invention is not anticipated by, and is not obvious in light of, the prior art. In response to the Office Action, however, the claims of the application have been further amended to more clearly state the scope of the invention. Reexamination and reconsideration of the application, and allowance of the claims is respectfully requested.

Applicant recognizes that a terminal disclaimer has been requested to overcome an obviousness type double patenting rejection. Applicant will make an appropriate terminal disclaimer when patentable subject matter presented in the subject application is identified as necessary. Currently, all pending claims stand rejected under 35 U.S.C. §102 or 103, and a terminal disclaimer is not warranted at this time.

Applicant, in the amendment in to the last Office Action immediately proceeding this Action, further defined the manganese compound of the present invention as comprising mononuclear organometallic manganese or as small clusters of manganese atoms. The amended claim language has been rejected under 35 U.S.C. 112, second paragraph as failing to set forth the subject matter that the Applicant regards as their invention. Specifically, the Examiner states the language "wherein the manganese compound is mononuclear or comprises small cluster of manganese atoms" is vague and indefinite. The Examiner requests further explanation of the term 'mononuclear' as well as an explanation as to why other manganese containing substances are not mononuclear. Moreover, the Examiner states that a "small" cluster is vague because the specification states, "small clusters *can* include about 2 to 50 atoms of manganese." The Examiner's position is that term 'small' is relative and indefinite despite the definitions in the previous response and in the specification of the application. The relevant text from the specification is, at least in part, as follows:

> The term "mononuclear" compound includes one where a manganese atom or a small cluster of manganese atoms is bound in a compound which is essentially organo-soluble. An example is an organometallic manganese compound that is soluble in various organic solvents. Compounds have "small clusters" of metal atoms include those with 2 to about 50 atoms of manganese. In this alternative, the metal atoms are still sufficiently dispersed or dispensable to be an effective catalyst for the combustion reaction. When discussing

solubility in terms of mononuclear and small cluster atoms, the term solubility means both fully dissolved in the traditional sense, but also partially dissolved or suspended in a liquid medium. As long as the manganese atoms are adequately dispersed in terms of single atoms or up to about 50 atom clusters, the manganese atoms are sufficient to provide a positive catalytic effect for the combustion reaction.

Examples of mononuclear compounds include organometallic compounds. Preferred organometallic compounds in an embodiment of the present invention include alcohols, aldehydes, ketones, esters, anhydrides, sulfonates, phosphonates, chelates, phenates, crown ethers, carboxylic acids, amides, acetyl acetonates, and mixtures thereof. Manganese containing organometallic compounds include manganese tricarbonyl compounds. Such compounds are taught, for example, in US Patent Nos. 4,568,357; 4,674,447; 5,113,803; 5,599,357; 5,944,858 and European Patent No. 466 512 B1.

It is thought to be self-explanatory that a mononuclear metal organometallic compound has one manganese metal atom stabilized by a ligand(s). MMT, for example, has one manganese metal atom stabilized by a methylcyclopentadienyl ligand and three carbon monoxide ligands. A "small" cluster is considered a cluster that comprises "up to about 50 atom[s]." The small cluster could also be stabilized by ligands.

It has been determined that there is a direct relationship between cluster/particle surface area and catalytic activity. Increasing cluster/particle size equates to a reduction in catalysis. The small particles of the present invention create atomic level homogeneous dispersions in hydrocarbon or aqueous matrices. In terms of combustion, small particles require a lower treat rate and are, therefore, more environmentally friendly. Small cluster organometallic compounds also operate more efficiently at a lower temperature.

The Examiner asks whether the phrase "small clusters can include about 2 to 50 atoms of manganese" means that a cluster can be less than 2 atoms of manganese and also still greater than 50. As plainly stated, a small cluster may be about 2 atoms up to about 50 atoms. The term "small" defines the range of atoms to be stabilized by ligands. Per the definition, greater than about 50 atoms would not be a small cluster/particle.

Applicant has amended the claims to specifically state the range considered to be a small cluster. Typically, when a term is defined in the specification, it is not necessary to rewrite the definition into the claims. However, as the Examiner has acknowledged that such an amendment would overcome the 112 rejection, reconsideration of the 112 rejection is respectfully requested.

The Examiner also asks, "How is no other manganese containing substances not mononuclear?" Compounds such as manganese naphthenate or manganese octoate are not mononuclear metal organometallic compounds because they have *many* manganese metal atoms being stabilized by much fewer (carboxylate) organic ligands. Such compounds exhibit a minimum particle size of about .03 micron (30 nanometers). The number of Mn atoms in particles of this size is many orders of magnitude larger than the about 50 atoms or less cluster/particle size of the organometallic compounds that the Applicant is defining as the invention. To put it another way, a 50 atom cluster organometallic compound has no detectable particle size (using, e.g., a Malvern Instrument Mastersizer 2000 with a minimum detection limit of about 10 nanometer). This size cluster is completely dissolved in a hydrocarbon matrix to give a homogeneous solution.

Unfortunately, given the 112 rejection, the amended language was not considered for the purposes of novelty and non-obviousness. The current 102 and 103 rejections do not address the newly claimed mononuclear or small cluster element, and are moot for the purposes of this response.

The Examiner, however, dismisses the discrepancy in particle sizes between the claimed invention and the cited references in the Examiner's response beginning at the bottom of page 6 of the Office Action. Clearly, had the amendment been more plainly articulated, the Examiner would know that a single atom of manganese or a small cluster of manganese atoms (i.e., less than or about 50 manganese atoms per cluster) defines a significantly reduced particle size. The particle sizes in the prior art are not even comparable to the size of the small atom clusters/particles of the present invention.

The Examiner's response states that a particle size range for Applicant's manganese compound is not found in the applicant's specification. This is a fundamental misunderstanding. The quoted specification text above establishes that the manganese compound is comprised of single manganese atoms or small clusters of 2 to 50 atoms. This is the particle size, albeit the particle size is on an atomic scale and is an order(s) of magnitude separated from the particle sizes disclosed in Kukin. In fact, Kukin teaches away from a particle size of less than .01 microns (10 nanometers). A single atom or a cluster of 2 to 50 atoms is less than 10 nanometers, as discussed above. This particle size element is found in each independent claim, as currently amended.

Applicant does not understand the basis for stating repeatedly that, "organometallic manganese compounds are not present in any of applicant's independent claims." Claim 1 reads "combining coal and an additive that comprises an organometallic manganese compound." This language is repeated in each independent claim as currently amended.

At no point does the Examiner argue that Kukin '820 discloses or suggests an organometallic compound. Instead, the '820 patent only teaches a "manganese-containing substance". As noted in the earlier discussion herein, it is believed that there is a significant physical distinction between inorganic substances generally that are made up of relatively large particles versus an organometallic manganese compound that includes small particles of manganese atoms. Therefore, the failure of Kukin '820 to specify "organometallic" manganese is a significant failure of disclosure. Moreover, Kukin '820 does not address organometallics with the particle size element of the currently amended claims.

In fact, Kukin '503 explicitly teaches away from the limitation that the manganese-containing additive is mononuclear or includes small clusters of manganese atoms. As set forth in Kukin '503, when the manganese is present in a particle size of less than .01 microns, the oxidized form of the manganese will form crystal growth patterns and agglomerate large size, manganese containing ash in the furnace that is harmful to a system. (Column 4, Lines 44-51). Applicant notes that .01 microns is still far larger than the mononuclear metal or small cluster organometallic of the claimed invention. In other words, Kukin '503 expressly excludes and explicitly teaches away from the use of a manganese-containing additive that includes small clusters of manganese atoms or a mononuclear metal organometallic. (See also Column 5, Lines 30-36).

Tables 1-4 in the '503 reference indicate the use of an organometallic manganese compound is shown to be unfavorable with respect to the negative ash properties of agglomerating ash on the inside of furnaces. The Examiner asserts that Tables II through IV are irrelevant because they refer not to coal combustion but to slag. Table II relates to Examples 4-11 (see Col. 16, lines 10-11). Example 6 states that Example 5 (the test involving fly ash) was produced from a sample of coal (see Col. 14, lines 65-66). The Examiner contradictorily notes that Example 5 appears to be relevant because it is the only example that is for coal combustion. Yet, Example 5 does not teach or suggest an organometallic compound. Table 1, which the Examiner also points to as being relevant, reveals that an organometallic manganese compound does NOT deliver the benefits sought

for and described in the patent or are at least less suitable than the inorganic compound. Therefore, the specific examples of Kukin corroborate the fundamental argument of Applicant that it would not be obvious to assume that a manganese-containing compound would reduce carbon in fly ash.

Applicant continues to feel the cited references are not reasonably applied to the present invention without the benefit of hindsight analysis. Importantly, they do not contain or suggest the small cluster or mononuclear sizes of the present invention.

For one or more of the foregoing reasons, Applicant submits that the application is in condition for allowance. The limitation of the present invention to manganese compounds that contain mononuclear or small clusters of manganese atoms is a significant clarification of the invention. Further, the differences between organometallic and inorganic manganese and between carbon in ash and soot/smoke are significant ones. Applicant respectfully submits that the references cited by the Examiner do not reasonably disclose nor render obvious the claimed invention. The rejections are traversed and Applicant respectfully requests that they be withdrawn.

It is believed that there are no fees associated with this filing. However, in the event the calculations are incorrect, the Commissioner is hereby authorized to charge any deficiencies in fees or credit any overpayment associated with this communication to Deposit Account No. 05-1372.

Respectfully submitted,

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